2024

COMPUTER SCIENCE — HONOURS

Paper : CC-6

(Computational Mathematics)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer ***question no.*** **1** and ***any four*** from the rest.

1. Answer ***any five*** questions : 2×5

(a) When is a relation said to be an equivalence relation? Explain briefly.

(b) State the Bayes' theorem on conditional probability.

(c) Define path and circuit of a graph.

(d) Show that $f(n) = 5n^2 + 6n + 2^n$ is of $O(2^n)$.

(e) State the Principle of Inclusion and Exclusion for n number of sets.

(f) Given a group of 6 Batsman, 7 All-rounders and 7 Bowlers. How many teams of 15 members can be formed?

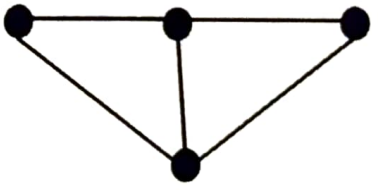
(g) Let $A = \{x, y, z\}$. Find all one to one functions $f : A \to A$.

(h) State the drawback of Simpson's 1/3rd rule for solving a definite integral.

2. (a) Prove that a simple graph with n vertices and k components can have at most $(n-k)(n-k+1)/2$ edges.

(b) Prove that in a simple connected graph with n vertices ($n > 1$) at least two vertices are of equal degrees.

(c) How many spanning trees of the graph shown below can be formed and why?



4+3+3

Please Turn Over

3. (a) State the condition when a system of linear equations is said to be strictly diagonally dominant. Solve the following simultaneous equations by Gauss-Elimination method.

$$3x + 4y + 2z = 15$$
$$2x + 3y + 2z = 10$$
$$5x + 2y + z = 18.$$

(b) What do you mean by an ill conditioned matrix? (2+6)+2

4. (a) Prove that the rate of convergence of Bisection method is linear.

(b) Find $f(1895)$ using Newton's Forward Difference formula.

x	1891	1901	1911	1921	1931
$f(x)$	46	66	81	93	101

5+5

5. (a) Solve the recurrence relation $F_n = 10\,F_{n-1} - 25\,F_{n-2}$, where $F_0 = 3$ and $F_1 = 17$.

(b) Let $f : R \to R : f(x) = 4x + 3 \quad \forall\, x \in R$. Show that f is invertible and find f^{-1}. 5+5

6. (a) Write an algorithm to find the solution of an equation $f(x) = 0$ using Secant method.

(b) Obtain a linear regression of y on x for the equation $y = a_1x + a_0$ and derive the regression coefficients. 5+5

7. (a) Using Runge-Kutta Second order method, find the value of y when $x = 1.1$ at given $\frac{dy}{dx} = 3x + y^2$ and $y = 1.2$ when $x = 1$.

(b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Simpson's one third rule. 5+5

8. (a) Check whether the following holds—

$(p \leftrightarrow q) \equiv (p \to q) \wedge (q \to p)$

(b) A coin is tossed 50 times, find the —

(i) number of possible outcomes.

(ii) probability of having exactly 20 heads and 30 tails. 5+(2+3)